

STABILITY IN AVIATION.

Stability in Aviation: an Introduction to Dynamical Stability as Applied to the Motions of Aëroplanes.

By Prof. G. H. Bryan, F.R.S. Pp. xi+192. (London: Macmillan and Co., Ltd., 1911.) Price 5s. net.

THIS book, in common with other published mathematical papers of Prof. Bryan, contains much original work. It is well worth study, not merely by mathematicians, but also by all interested in the practice of aviation and in the design of flying machines. In the preface and introduction the author indicates his reasons for undertaking this investigation, and his desire to make the book practically useful. It will be universally agreed, and the conclusion is confirmed by experience, that the greatest difficulties which must be surmounted in connection with aërial navigation arise from lack of exact knowledge of the principles of dynamical stability as applied to the motions of aëroplanes. Up to date it is probably correct to say that individual skill—often apparently almost instinctive—on the part of airmen, and their immediate readiness to act when sudden emergencies arise, play the greatest part in the safe conduct of aërial machines. In fact, having regard to endless possible variations in the conditions which are, and will be, encountered in aërial navigation, these personal qualities will always remain essential to success. On the other hand, there can be no dispute but that substantial advantages may be gained from the results of work done by mathematicians like Lord Rayleigh, Sir George Greenhill, and Prof. Bryan.

It is true that all mathematical investigations must be based on certain assumptions; and, because of our imperfect knowledge of atmospheric phenomena, errors have been, and will be, made in these assumptions, and important considerations may be omitted in framing equations. In consequence of these limitations mathematicians run a risk of claiming more for their conclusions than they are really worth. Prof. Bryan himself has not escaped entirely free from this danger in previous utterances on the subject of aviation; but in the book under review he puts the case for mathematical inquiry in a form to which no one will take exception. The passage is of sufficient interest to justify quotation, and the more so because it strikes the keynote of the book itself:—

"In this book attention is concentrated on the mathematical aspect of the problem for several reasons. In the first place, there is no obvious alternative between developing the mathematical theory fairly thoroughly and leaving it altogether alone; any attempt at a *via media* would probably lead to erroneous conclusions. In the second place, the formulæ arrived at, even in the simplest cases, are such that it is difficult to see how they could be established without a mathematical theory. In the third place, there is probably no lack of competent workers interested in the practical and experimental side of aviation, and, under these conditions, it is evident that the balance between theory and practice can be improved by throwing as much weight as possible on the mathematical side of the scale. Lastly, it is hoped to advocate the claims of aëroplane equilibrium and

stability as an educational subject suitable for study in our universities alongside with such branches of applied mathematics and mathematical physics as hydrodynamics, and particle and rigid dynamics."

If it were necessary to choose between purely mathematical investigation and experimental research in connection with the development of aviation, the latter method would necessarily be preferred. No such choice has to be made, however, since progress can only be achieved if there is a close association of mathematical analysis with experimental methods.

Readers of Prof. Bryan's book will be impressed with the suggestiveness of many passages in which results of mathematical solutions of difficult problems are discussed. Even if all the mathematical processes in the book cannot be followed by practical men, their attention may well be turned to its pages, and they cannot fail to derive instruction and obtain guidance therefrom in determining directions in which further experimental research may most advantageously be undertaken.

Prof. Bryan anticipates "that the successful aëroplane of the future will possess inherent, not automatic, stability, movable parts being used only for the purposes of steering." He considers the use of gyrostats, pendulums, or other movable parts which are intended to provide automatic stability to be undesirable, because such parts are liable to get out of order, while "they increase the degree of freedom of the machines and add to the number of conditions which have to be satisfied for stability." There is sound common sense in this observation, and its force has been emphasised by experience in submarines. After many attempts to devise and apply means for automatic control of longitudinal stability, it has been universally agreed that manual control by competent steersmen is on the whole to be preferred. The case of the submarine is, of course, vastly simpler, and the conditions of service less complex and variable than are those to which aërial machines are exposed; but the principle holds good in both instances. The "human element" is all-important.

It is both unnecessary and undesirable to attempt any detailed description or criticism of the mathematical chapters of this book. They are marked both by an ability and a compactness which are not surprising to those who know the character of Prof. Bryan's mathematical papers. He has had the advantage of help from Mr. E. H. Harper and other gentlemen, to whom due acknowledgment is made, and by whom the whole of the formulæ have been checked. Prof. Bryan hopes that the formulæ are correct, but modestly adds:—"It is impossible to be too careful in a matter where a mere slip of a sign might change stability into instability." Readers are, therefore, invited to check the formulæ for themselves—an invitation which may have an attraction for mathematicians, but not for all who will study the results recorded in these pages.

The volume is admirably produced, and it constitutes a valuable addition to the series of "Science Monographs," to which it belongs.

Special interest now attaches to the subjects treated;

and, in addition, it may be hoped that the wish expressed by the author will be fulfilled, and that the book will be used as a text-book for students of mathematics and physical science in the universities.

W. H. W.

STAMMERING.

The Real Cause of Stammering and its Permanent Cure: a Treatise on Psycho-Analytical Lines. By A. Appelt. Pp. ix+234. (London: Methuen and Co., Ltd., 1911.) Price 3s. 6d. net.

MANY theories have been advanced to explain the distressing complaint known as stammering, and the modes of treatment have been equally numerous. The treatment has often fallen into the hands of quacks, who have pursued empirical methods without any insight into the real nature of the affliction. The author of this book suffered during his early youth and manhood; he put himself under the care of specialists, and he was an inmate of three institutions; but the result was only failure and relapse. He now considers himself to be completely cured by a method entirely different from that usually followed, and he gives the result of his investigations and experience in this interesting volume.

The subject is introduced by a concise historical account of the notions that prevailed for centuries as to the cause of stammering. The Jews, the Greeks, and the Romans paid much attention to impediments in speech, but it was not until the sixteenth century that a real beginning was made by special observations by some of the early physicians. From that time much has been written and many theories have been advanced. The articulating mechanism was held to be at fault; weakness of the soft palate; defective movements of the tongue; abnormal movements of the larynx; spasm of the glottis, all received blame. The discovery of reflex action, about 1841, led to the view that stammering was due to a reflex spasm caused by excito-motor spinal action predominating over cerebral activity. Cerebral congestion, spasms of the vessels in the brain, intense emotional excitement, insufficiency and irregularity of respiration, and abnormal nervous irritation were adduced as explanations. It is dreadful to realise that some of these erroneous theories led to severe surgical operations, such as cutting through the base of the tongue, and it was not until 1851 that surgical treatment was abandoned as worse than useless. The view that the impediment existed in the outer organs of speech was at last definitely abandoned, but it was only since the beginning of the present century that investigators have come to the conclusion that stammering is a psychical ailment, and that the special cause is a feeling of dread, "the dread of speaking," and that to effect a cure the psychic influences or impulses must be met by counteracting suggestions.

The author gives a very interesting account of the mechanism of speech, not in the ordinary sense, but of the origin of the art of speaking in the child. Nowhere have I read a better account of how baby is influenced in the production of vocal sounds by

feelings of comfort or the reverse, of how he hears his own voice, and associates the sounds with those feelings; and so on, step by step, until the sounds express ideas which are associated with baby himself, or with his parents, or those about him. There is then a full account of the pathology of stammering, and it is shown how all the irregular movements are preceded by a feeling of dread. The stammerer dreads the effort, and the greater the dread the worse the stammering, until, in extreme cases, there is positive mental torture, which reacts on the psychological condition of the sufferer, and may even alter his character. It is remarkable that there is no spasm of the glottis: "the closure of the glottis ceases instantaneously when the stammerer gives up his intention to speak." In this otherwise excellent description the author uses the word "anelectrotonus," but as this word has a very definite meaning in electro-physiology, it would be better to avoid its use as applied to the phenomena described by the author. The author also often describes affections of "nerves" when he evidently means "nerve centres." Nerves are conductors; the intimate phenomena of nervous action take place in the collocations of nervous matter we call "centres," although it must be confessed we know very little about the phenomena occurring therein.

The author then comes to the essence of his theory, namely, that stammering is essentially a psychic disturbance. At the root of speech lie the emotions; the results of emotional states may remain long in a hidden condition, or are awakened only now and then. Such emotional conditions may be repressed, and from the days of infancy they are habitually repressed. Thus we may consider them to be in a state of tension, and this tension may disturb the centres for speech, if it is associated with feelings of dread. These feelings of dread may have first originated in childhood, and for years they may exist in the mind unconsciously. The author holds strongly the modern view of unconscious mental operations that develop into a second, and usually hidden, self. This implies that there may be *mental* operations without consciousness. With this modern view I cannot agree. It is not necessary for me, however, to state my objections here, but rather to give a fair account of the author's view, which he regards as the kernel of his theory. This unconscious mind is a psychic complex endowed with extremely intense emotions and inhibitions. The individual is under its influence, and "the physical and psychic symptoms of defective speech are merely projections of the conflicts piled up in the emotional complex." The unconscious psychic complex is often in conflict with the conscious ego, and a feeling of dread, of dread of the unknown and mysterious, more than simply a feeling of fear, precedes the articulatory disorder.

This psychological view leads to a rational therapeutics. Abandon exercises in elocution; give up the dreaded pronunciation of certain words; try the effect of auto-suggestions, such as "I shall get over this and soon be quite well"; submit to hetero-suggestions of the same kind originating in the teacher or trainer, in whom the